REMARKS

Drawing Objections

FIG. 1 has been corrected to include a "Prior Art" legend as suggested by the Examiner.

Specification Objections

The specification is objected to for failing to comply with 37 C.F.R. 1.77(b). Accordingly, applicants have amended the specification to include the appropriate section headings as suggested by the Examiner. Thus, applicants submit that the specification is now in compliance with 37 C.F.R. 1.77(b).

Claim Rejections

Applicants have thoroughly considered the Examiner's remarks in the January 16, 2004 action. By this Amendment A, claims 1, 5, and 7 have been amended and claims 2 and 6 have been canceled. Claims 1, 3-5, and 7-12 are now presented in the application for further consideration. Applicants respectfully request allowance of the application in light of the amendments and following remarks.

Claims 1-5, and 8-10 stand rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,046,507 to Hatchard et al.

Claim 1 has been amended to clarify the invention as follows:

1. A method of assembling a semiconductor device package comprises:
(i) attaching a semiconductor device to a die-pad area of a leadframe;

(ii) forming electrical connections between electrical contact areas on the semiconductor device and electrical contact areas on the leadframe to form a device/leadframe assembly;

(iii) electrolytically depositing an adhesion enhancing coating by an electroplating process on the entire exposed surfaces of the device/leadframe assembly; the enhancing coating being in the form of an inorganic material comprising metal oxide, and

(iv) encapsulating the coated device/leadframe assembly in an electrically insulating material.

The amendment more specifically claims the material of the adhesion enhancing coating as described at page 5 (since it is described that the inorganic coating can be Olin A2 and thus such coatings inherently have metal oxide). Further, it clarifies the deposition process (former claim 2 is thus deleted) and that the coating is deposited on the entire exposed surfaces of the device/leadframe assembly prior to encapsulation, as is clear from Figures 2 and 3 and the corresponding description explaining these figures.

Hatchard et.al. disclose an electrophoretic coating method to improve internal package delamination and wire bond reliability. Column 6 lines 6 to 21 disclose depositing a coating material, such as an unpolymerised monomer, by electrostatic deposition onto all of the conductive surfaces of the leadframe assembly. However, as it would be appreciated, the coating material suggested by this prior art is organic material. Further, the deposition process taught in this prior art is electrostatic deposition by means of vapour deposition, electrostatic spray, or electrophoretic deposition of coating materials.

In contrast to the cited reference, amended claim 1 recites "electrolytically depositing an adhesion enhancing coating in the form of an inorganic material comprising metal oxide by an electroplating process on the entire exposed surfaces of the device/leadframe assembly." The use of an inorganic material obviates a need for curing, unlike organic material. Further, the use of inorganic material comprising metal oxide to provide an enhancing layer provides an excellent protective coating to reduce reliability problems at the joints. Thus, applicants submit that amended claim 1 is novel over this prior art citation.

Applicants further submit that it would not be obvious to modify the teachings of Hatchard et al. to arrive at the present invention. A skilled person reading Hatchard et al. would understand that to coat the completed leadframe/semiconductor chip/wire bond assembly, organic materials would be the best choice since this document does not suggest the use of an inorganic material as the coating. Further, the document does not teach any deposition method that is suitable for depositing inorganic coatings, which comprise metal oxides. Consequently, there is no motivation for a person skilled in the art to modify the prior art teachings to arrive at the present invention since the document does not contemplate alternatives to the organic coating material. Thus, the amended claim 1 is not obvious in view of this document.

Applicants recognize that Parthasarathi et al. disclose the use of an inorganic, metallic coating such as Zn-Cr. However, Parthasarathi et al. disclose coating the lead frame with a metallic layer containing chromium or Zinc by electroplating before connecting the lead frame to an electronic device (see for example at column 2 lines 56 to 62, column 5 lines 17 to 25 and column 6 lines 5 to 8). Thus, the deposition of the metallic coating is performed before the electronic device is mounted and thus the coating is not formed on the surfaces of the electronic device. A skilled person reading this prior art would understand that it is technically difficult to electroplate the entire completed lead frame/semiconductor/bond wire assembly since this would require immersing the assembly into an electroplating bath, which would be inconceivable since this would mean that the semiconductor could be exposed to contamination. Consequently, a skilled person, without impermissible hindsight, faced with an object of reducing the delamination of the entire assembled package would understand that the teachings of Hatchard et al. would be preferred over the teachings of Parthasarathi et al. if he or she wants to coat the entire completed lead frame/semiconductor/bond wire assembly. Further, there is no suggestion of any advantage of coating the entire assembled package with an inorganic material comprising metal oxide and thus there is no motivation for a skilled person to combine both documents to arrive at the present invention.

Therefore, we submit that claim 1 as amended is patentably distinguished from the cited documents. Claim 5 has been amended in a similar manner as claim 1, and is believed to be allowable for at least the same reasons.

Claims 5 and 12 stand rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,633,529 to Otusuki et al., and claim 5 also stands rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6, 107,690 to Courtenay et al.

Osuki discloses a resin sealing type semiconductor device. At column 17, lines 1 to 20 and Figures 19A to 19D describe the steps for resin sealing which describes forming a resin seal 90 over the wires 40, semiconductor element 20 and leads 30.

Courtenay discloses a method for coating a semiconductor die/leadframe assembly prior to encapsulation. Although Courtenay discloses the use of polyimide or other suitable adhesion promoting material as the coating material, Courtenay fails to teach or suggest using a metallic, inorganic material as the coating material.

In contrast, unlike what is disclosed in Osuki and Courtenay, amended claim 5 clarifies that the semiconductor device has an adhesion enhancing coating in the form of an inorganic material comprising metal oxide on the entire surfaces of the lead frame, electrical connections and the semiconductor device. This is particularly advantageous since the inorganic material is also deposited on the exposed surfaces of the semiconductor device and thus helps to reduce popcorn cracking. Thus, applicants submit that amended claim 5 has novelty over the prior art citations.

Applicants also submit that amended claim 5 is not obvious over these documents. None of these documents suggests covering the entire surfaces of the lead frame, electrical connections and the semiconductor device using an inorganic material comprising metal oxide and which is also an adhesion enhancing coating. A skilled person reading these documents would thus follow the teachings therein to form a layer of coating using organic material on the lead frame, electrical connections and semiconductor device since these documents do not teach specific alternatives which would lead a skilled person to form a coating in the form of an inorganic material comprising metal oxide on the entire exposed areas.

Claims 6, 7, and 11 stand rejected 35 U.S.C. 103(a) as being obvious in view of Courtenay et al. and further in view of U.S. Patent No. 5,633,529 to Parthasarathi et al.

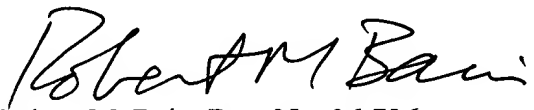
As for the teachings of Parthasarathi et al., applicants submit that it would not be obvious to combine this document and the Osuki or Courtenay references to arrive at the present invention for the same reasons as submitted earlier for amended claims 1 and 5 above. Claims 7 and 11 depend from claim 5 are believed to be allowable for at least the same reasons as the claim from which they depend.

Applicants also submit that the rest of the documents cited but not applied by the examiner are not any more relevant than the above documents, since none of these documents discloses electrolytically depositing an adhesion enhancing coating in the form of an inorganic material comprising metal oxide on the entire exposed surfaces of the semiconductor device/lead frame assembly by an electroplating process.

In view of the foregoing, applicants respectfully submit that claims 1, 3-5, and 7-12 are allowable and that the subject application is now in condition for allowance.

The Commissioner is hereby authorized to charge $950 for a three (3) month extension of time up to and including today's date to Deposit Account No. 19-1345.

Respectfully submitted,



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